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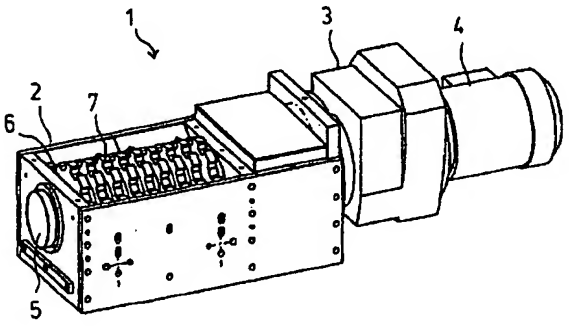
(54) Single-shaft chip shredder

(57)

Single-shaft chip shredder for shredding chips from metal or plastic materials, equipped with a housing (2) encasing the shaft (5), a chamber for collecting chips (10) located above the shaft (5) and a chamber for catching chip shreds (12) located below the shaft (5) that are separated by counter-blades (8) on both sides of the shaft (5) for the cutting blades (6) located on the shaft (5), cutting blades (6) that have disc-shaped blade units (13) with cutting teeth arranged around their outside edges, and a driving device (4) for the shaft (5) and a controller wherein
the cutting teeth (7) are essentially designed as cutting teeth (7) that are symmetrical in both rotation directions,
a number of said cutting teeth (7) are arranged on each blade unit (13),
the counter-blades (8) are inclined at a downward slant on both sides of the shaft (5) so that the cross-section of the chip collection chamber (10) has a cross-sectional aspect similar to that of a funnel, and
the controller continuously reverses the rotation direction of the shaft (5) during the cutting process at a predefinable time interval.



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Single-Shaft Chip Shredder

Description

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This invention pertains to a single-shaft chip shredder designed to shred materials that produce chips, particularly metal or plastic per the general concept in Claim 1.

Common chip shredders are used to shred chips of various lengths and shapes as generated during chipping processes so that they can later be better disposed of and recycled. The challenge in the area of chip shredding is to provide chip shredders that are capable of shredding all types of chips, especially the so-called chip dust balls, without causing operational downtime, i.e., an interruption in the production flow. Currently available, for example, is a chip shredder embodying disc-shaped blade units on a shaft with two pointed cutting teeth installed opposite from each other and extending far beyond the edge of the unit in the form of a grabber hook designed to grab the chip dust balls and to grind them up.

However, this is generally unsuccessful because the balls escape the teeth and remain in the chip collection chamber without enough of them being captured by the blades and shredded. This inevitably leads to stoppage of the entire system after a certain period of time. The size of the chip shreds is determined by filter screens placed underneath the blades in the usual manner.

Previous attempts to solve this problem involved two-shaft chip shredders, which, however, had to be equipped with the necessary screens in order to limit the size of the shreds. Two-shaft chip shredders are significantly more expensive and do not get the job done completely either.

The objective of this invention is therefore to propose a single-shaft chip shredder that captures and shreds with certainty all types of chips, including chip dust balls, at the desired rate, thus eliminating disruptions of the production process.

This task is resolved through the invention of a single-shaft chip shredder with the characteristics described in Claim 1. Additional beneficial embodiments can be obtained from the secondary claims.

Per the claims, the uniqueness of the single-shaft chip shredder described by this invention lies in the fact that the cutting blades are designed essentially as symmetrical cutting blades for bidirectional operation, a number of such cutting blades being installed on each cutting unit, the counter-blades being inclined at a downward slant on both sides of the shaft so that the cross-section of the chip collection chamber looks like a funnel, and the controller continuously reversing the rotational direction of the shaft at a pre-set time interval. This means that the rotational direction changes continuously during the

the cutting process according to the anticipated chips and chip dust balls, and that in particular any chip dust balls not properly collected in the one rotational direction will eventually be grabbed and shredded after a change in direction due to the change in position. In some situations, several changes in rotational direction may be required before a particular chip dust ball is eventually shredded. However, a device of this type will with certainty prevent system stoppages, due to the fact of all of the chips and chip dust balls being shredded. Due to the change of the rotational direction, the single-shaft chip shredder must be laid out symmetrically to the shaft, since both rotational directions are applied equally.

A chip shredder designed in this way has the advantage that the counter-blades form a closed surface with trough-like recesses for the mating of the cutting teeth, thus preventing any unshredded chips from passing through. The size of the chip shreds is determined by the geometry of the blades and the counter-blades, as well as the distance between the blade discs. It is therefore not absolutely necessary to place a filter screen underneath the shaft, as is common practice. Nevertheless, in another preferred embodiment of the device, in some cases it may be useful to place at least one screen between the blades and the chip shred collection chamber.

As indicated above, it is important for a chip shredder of this type that each cutting unit is equipped with a large number of teeth, since this is the only method to shred any potential chips or chip dust balls at the desired rate. According to one embodiment of the invention, a minimum of four cutting teeth is required. Better yet are a larger number of teeth, like eight or ten, for example. More teeth create smaller chip spaces between the cutting teeth, and are therefore preferred.

For cost-effective manufacturing, it has proven useful to mount the blade discs on a spline shaft. Spacers of appropriate thickness are located between the individual blade discs.

This type of single-shaft chip shredder design is unique by virtue of its simple construction using as few parts as possible, and due to the fact that it can therefore be manufactured very inexpensively. As mentioned above, it is also capable of reliably shredding all types of chips, notwithstanding its simple design. An additional advantage is the fact that the useful life of the blades is doubled by the bidirectional use compared to a single-shaft chip shredder using only one rotational direction.

Following below is a description of the invention in greater detail, using an embodiment sample and its associated drawings. The figures illustrate the following:

Figure 1	3D-View of a single-shaft chip shredder;
Figure 2	Top view looking down on the chip shredder shown in Figure 1, and
Figure 3	Cross-sectional view along line A-A as shown in Figure 2.

The single-shaft chip shredder shown in Figure 1 is unique by virtue of its compact and simple design. It consists of a Housing 2, whose front end is equipped, via Gear 3, with Motor 4, which drives the Shaft 5 that extends along the longitudinal axis of the housing. The inside of the chip shredder is designed to contain a commonly known control device, which is not shown here, but which reverses the rotational direction of the motor according to a preset time interval. The length of the time interval depends on the chips to be shredded.

As shown in Figure 2, evenly spaced Blade Discs 6 with a number of Cutting Teeth 7 are installed on Shaft 5. In this embodiment, as shown in the cross-section in Figure 3, ten Cutting Teeth 7 are being used. The Top View in Figure 2 shows that the individual Cutting Teeth 7 have a rectangular shape and mash into the corresponding Recesses 8 in Plates 9, which comprise the bottom of Chip Collection Chamber 10. The Gaps 11 between the Blade Discs 6 are filled by the Spacers 11, whose diameter matches the Plates 9 in this area so that no sufficient room is generated enabling chips to travel from Chip Collection Chamber 10 into the Chip Shred Collection Chamber 12 below, shown in Figure 3.

The cross-sectional view in Figure 3 provides a clear view of Blade Unit 13 with the Blade Discs 6 and the Cutting Teeth 7. This figure also shows that the design of the Cutting Teeth 7 is the same for both rotational directions and exhibits a so-called Janus tooth shape in the embodiment. A Spacer 11 is located between the individual Blade Discs 6. The design allows quick installation due to the fact that Shaft 5 is designed as a spline shaft, onto which the individual Blade Discs 6 can be mounted alternating with the Spacers 11. This embodiment also includes a common Filter Screen 14 mounted between the Cutting Teeth 7 and the Chip Shred Collection Chamber 12. The Counter-Blades 8 are inclined at a downward slant, thus forming a funnel-shaped Chip Collection Chamber 10.

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The Plates 9 for the counter-blades are usually manufactured of tempered, wear-resistant steel.

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Patent Protection Claims

1. Single-shaft chip shredder for the shredding of metal of plastic chips with a housing (2) in which the shaft (5) is encased,
a chip collection chamber (10) located above the shaft (5), and a chip shred collection chamber (12) located below the shaft (5)
separated by counter-blades (8) on both sides of the shaft (5) for the cutting blades (6) located on the shaft (5),
cutting blades (6) with disc-shaped blade units (13) with cutting teeth (7) on their outside edges, and
a driving device (4) for the shaft (5) and a controller **wherein**
the cutting teeth (7) are essentially designed as cutting teeth (7) for symmetric operation in both rotational directions,
a number of said cutting teeth (7) are attached to each blade unit (13),

the counter-blades (8) are inclined at a downward slant on both sides of the shaft (5) causing the cross-section of the chip collection chamber (10) to resemble a funnel, and

the control device continuously reverses the rotation of the shaft (5) during the cutting operation at a predefinable time interval.

2. Single-shaft chip shredder as described in Claim 1, **wherein** at least one filter screen (14) is located between the cutting teeth (7) and the chip shred collection chamber (12).

3. Single-shaft chip shredder as described in Claims 1 or 2 **wherein** the counter-blades (8) form a closed surface (9) with trough-like recesses (8) for mating with the cutting teeth (7).

4. Single-shaft chip shredder as described in one of the claims above **wherein** the number of cutting teeth (7) is at least four.

5. Single-shaft chip shredder as described in Claim 4 **wherein** the number of cutting teeth (7) ranges from eight to ten.

6. Single-shaft chip shredder as described in one of the claims above **wherein** the blade discs (6) are mounted on a spline shaft (5).

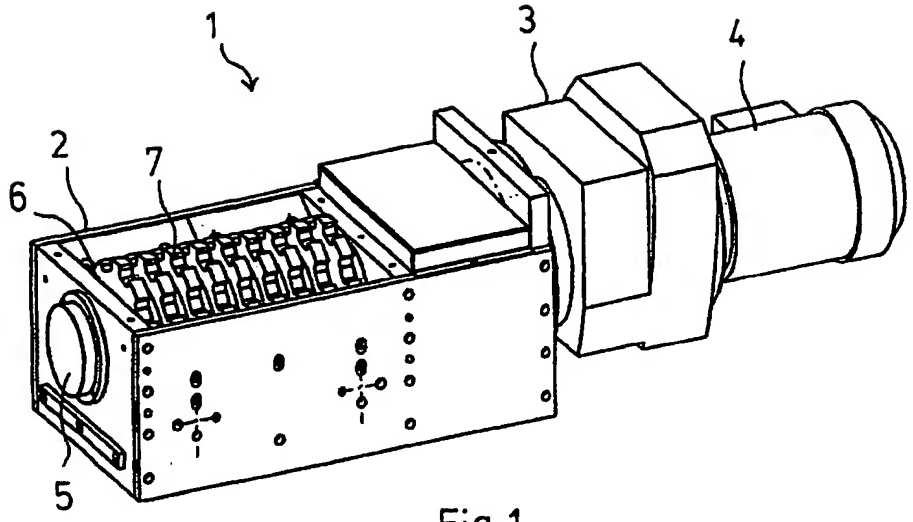

Fig.1

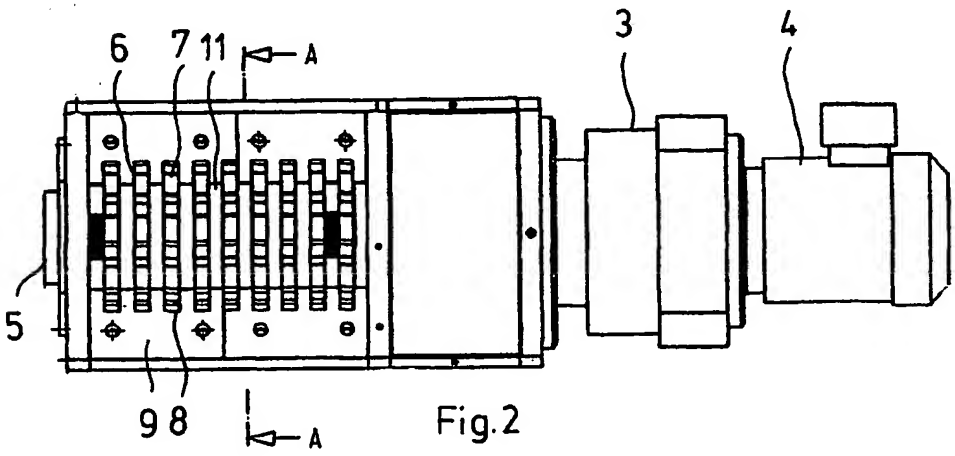

Fig.2

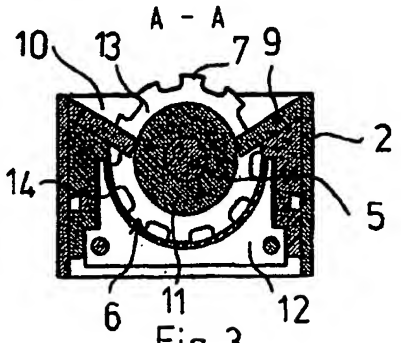

Fig. 3